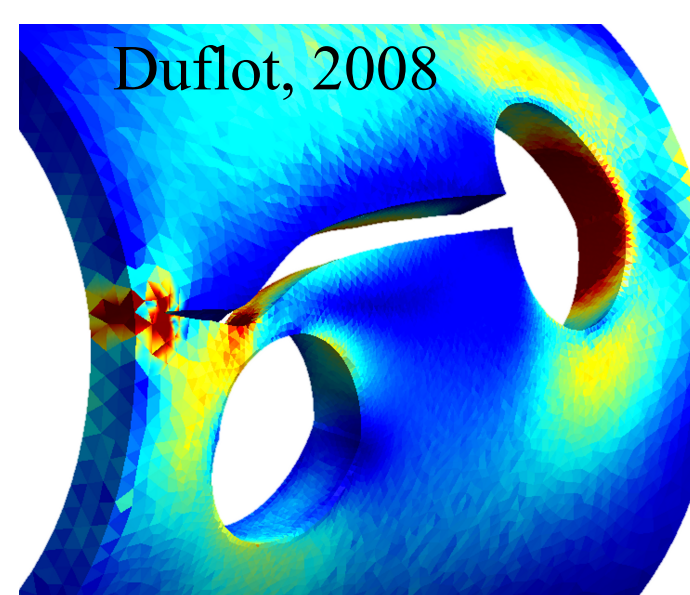


## Advanced Discretisation for free boundary problems

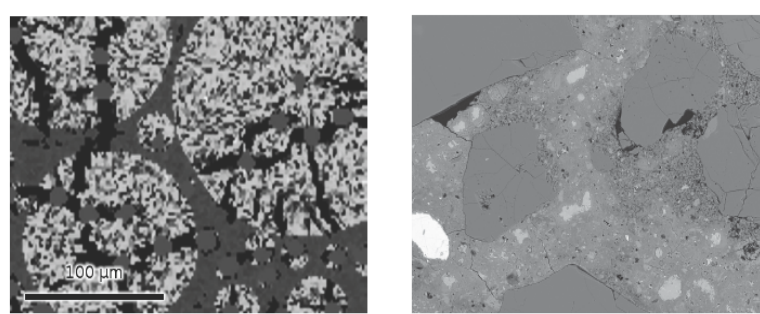
### Methods

- eXtended finite element and Meshfree Methods
- Smoothed Finite Element Methods
- Polyhedral elements

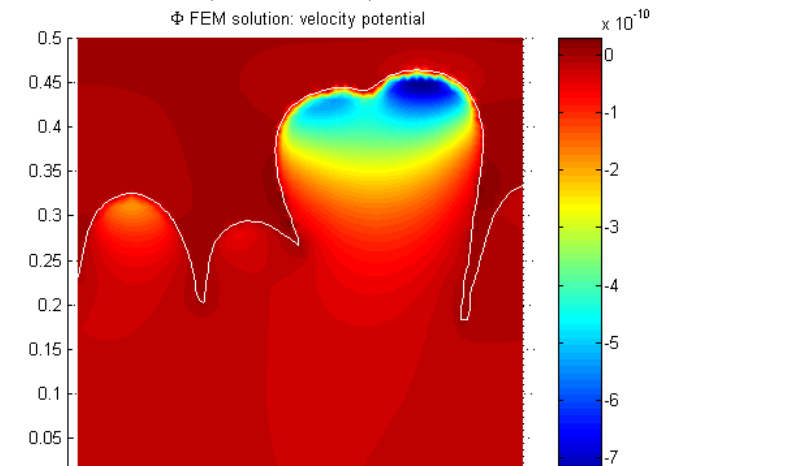


Dufloy, 2008  
3D fracture without remeshing

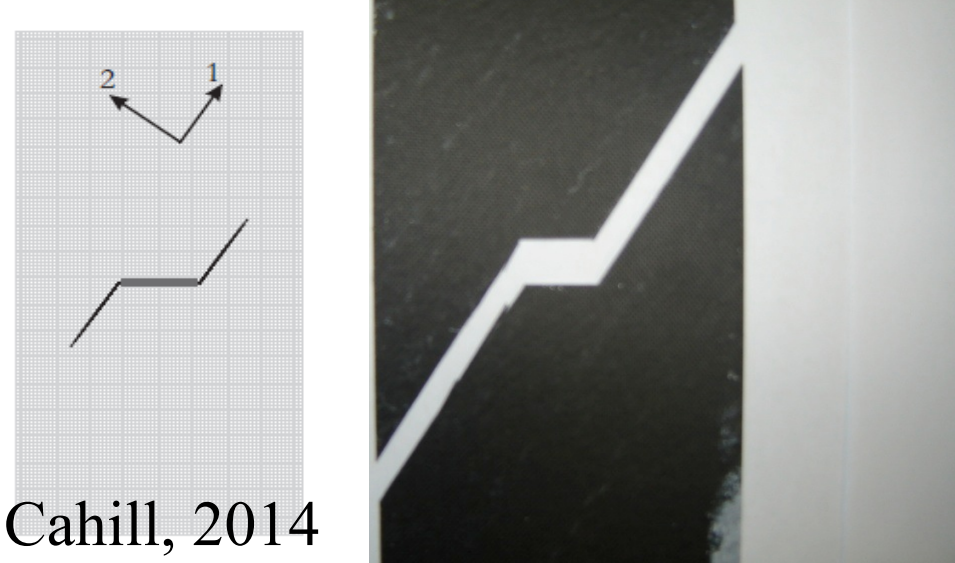
## Avoid remeshing, locking & simplify meshing Interactivity



Dunant, 2011, Alkali Silica



Duddu, 2008, Biofilm growth

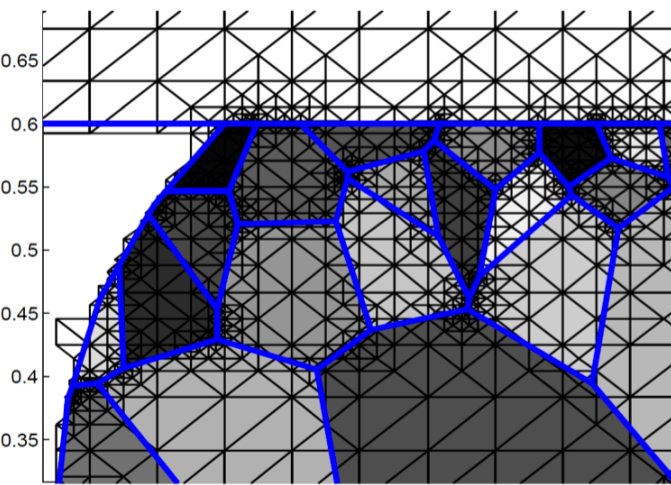


Cahill, 2014

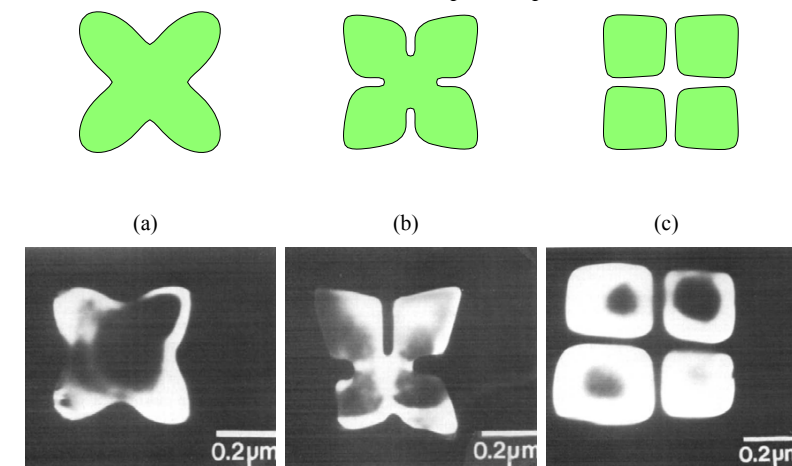
Composite Fracture driving force



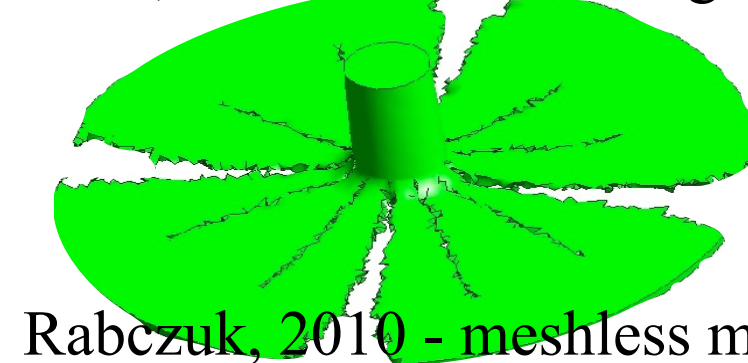
Sutula, 2015, Multi-crack growth in Silicon wafers



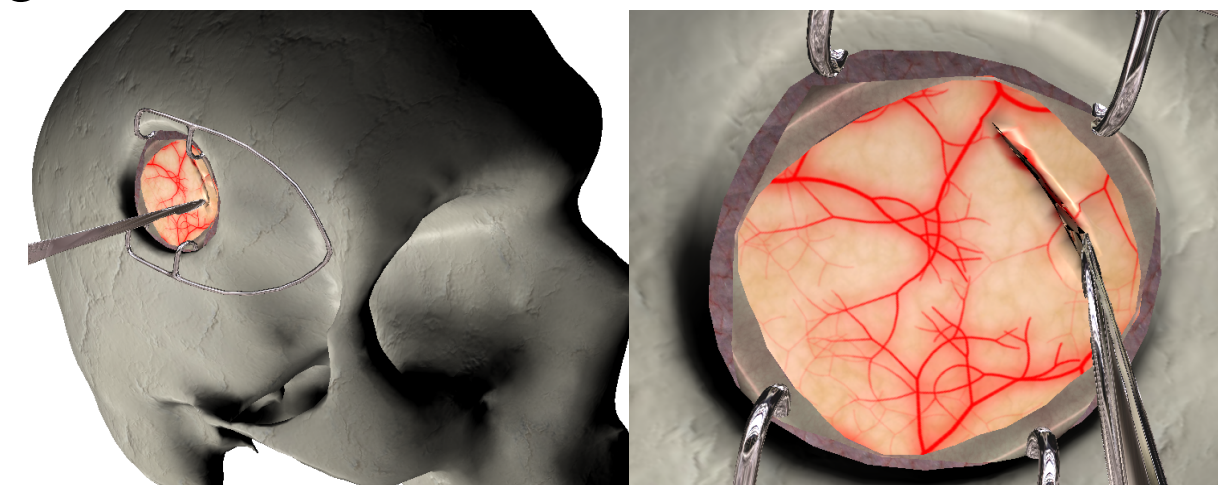
Menk, 2011, Polycrystals



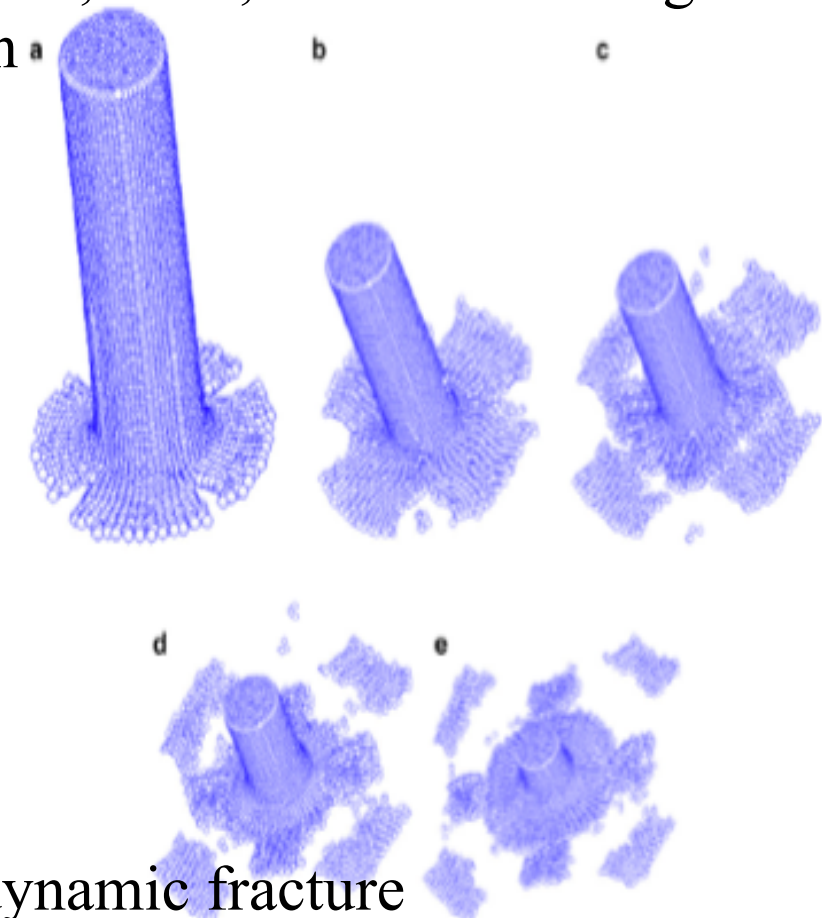
Zhao, 2014 - nanoinhomogeneities



Rabczuk, 2010 - meshless methods for dynamic fracture

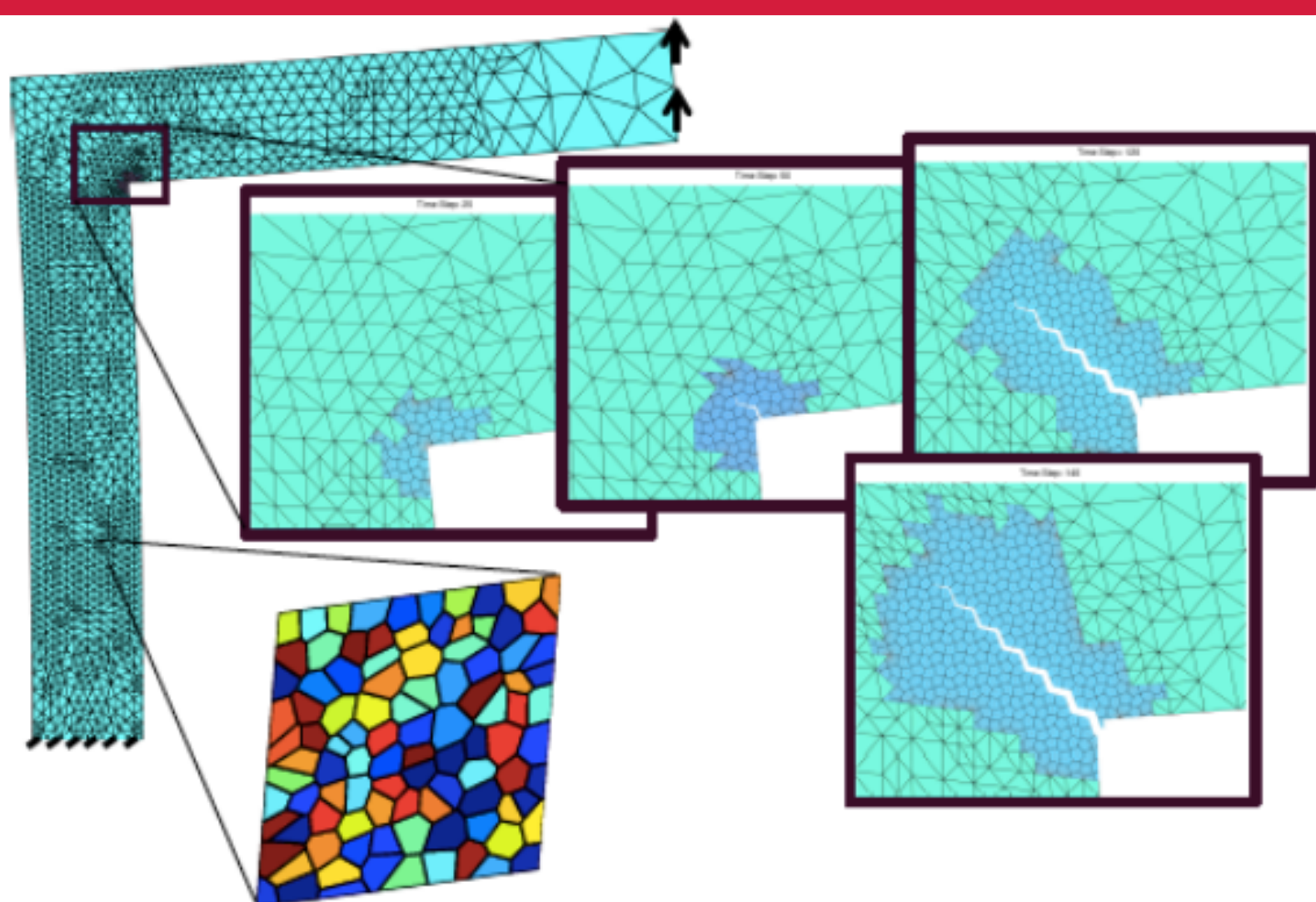


Courtecuisse, 2014, real-time cutting simulation

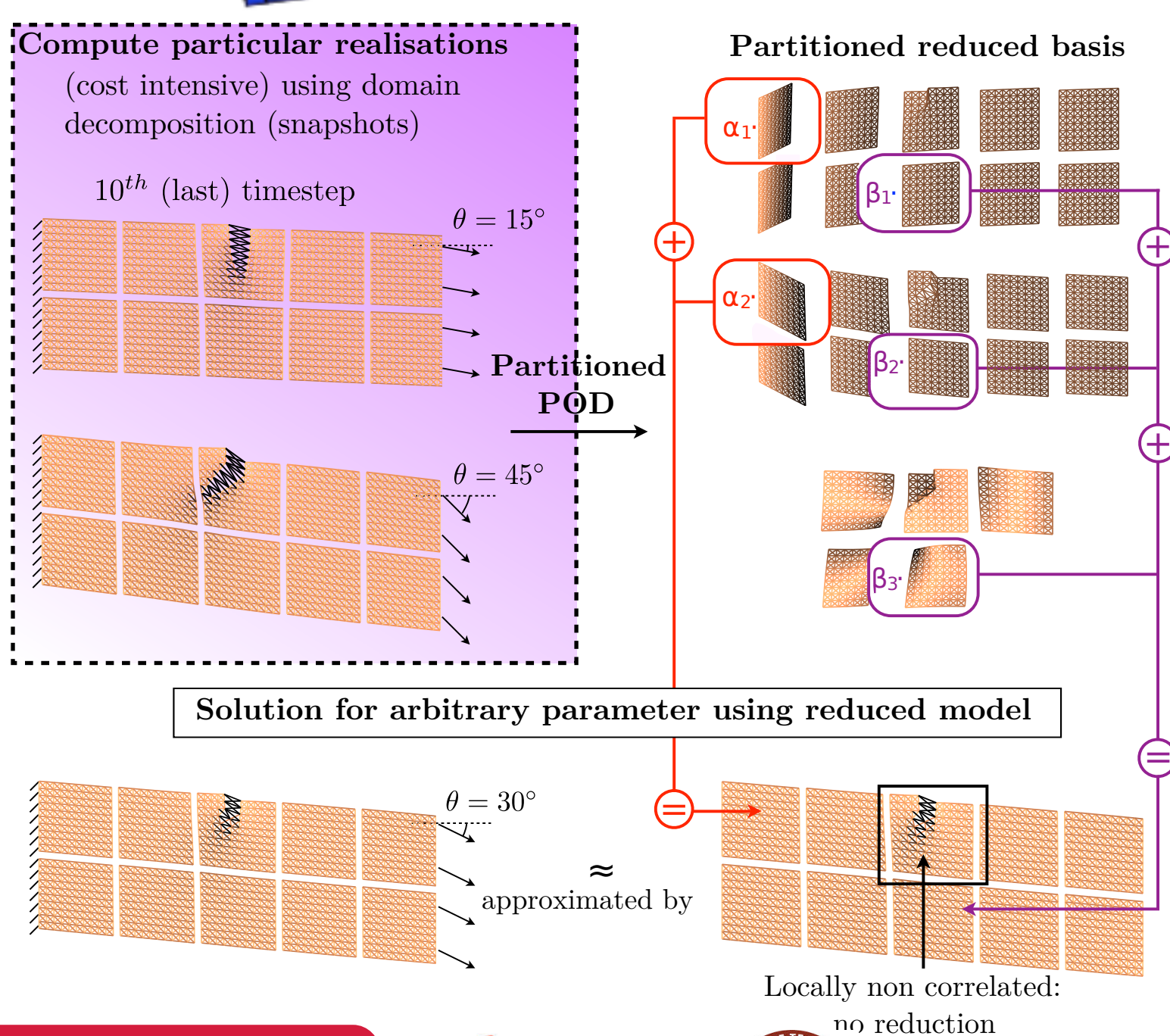


## Model Reduction Methods for Fracture

### Physics-based

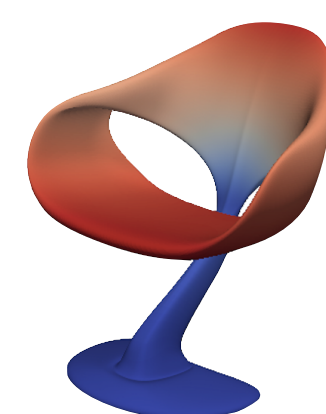


### Algebraic reduction



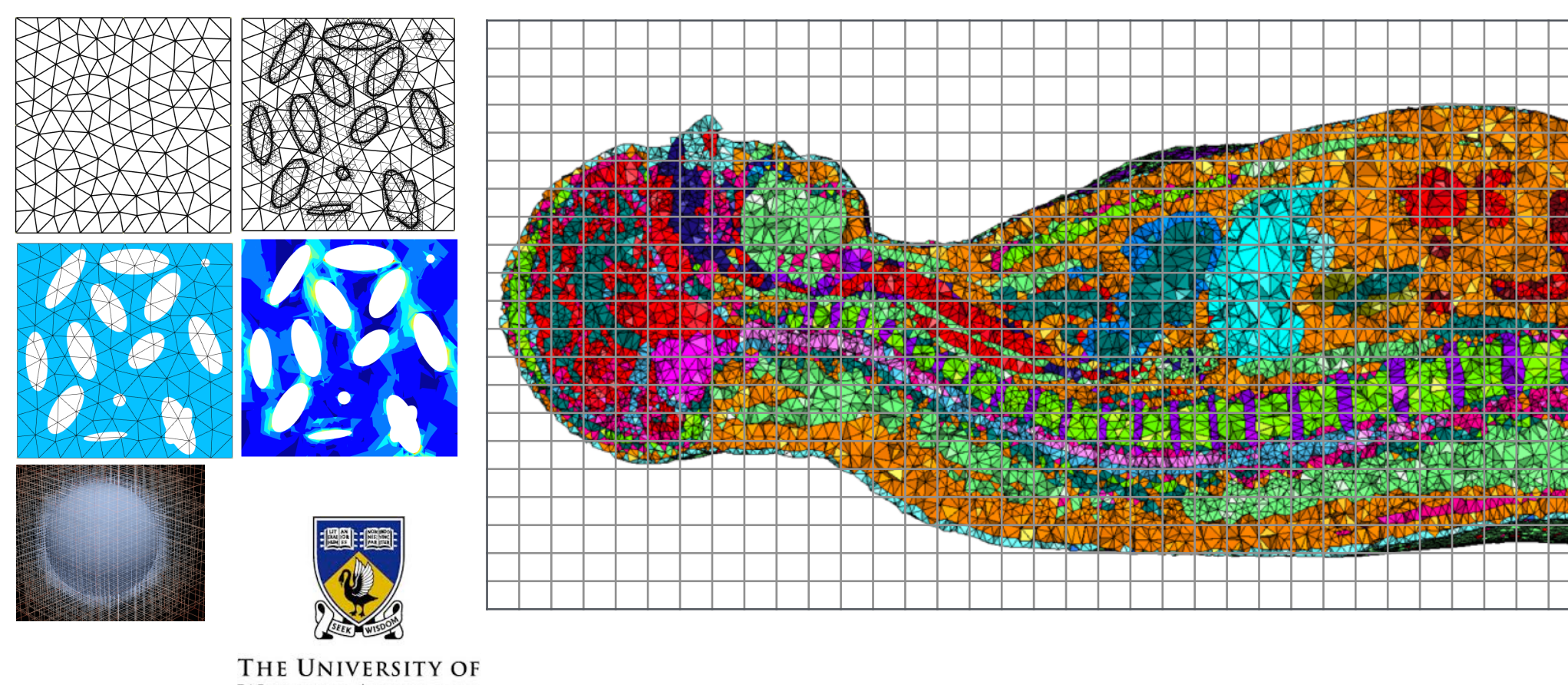
## Goal-oriented Error Estimation Adaptivity

- Model selection?
- How to optimise the element size?
- Recovery-based error estimation
- Constitutive relation error estimation

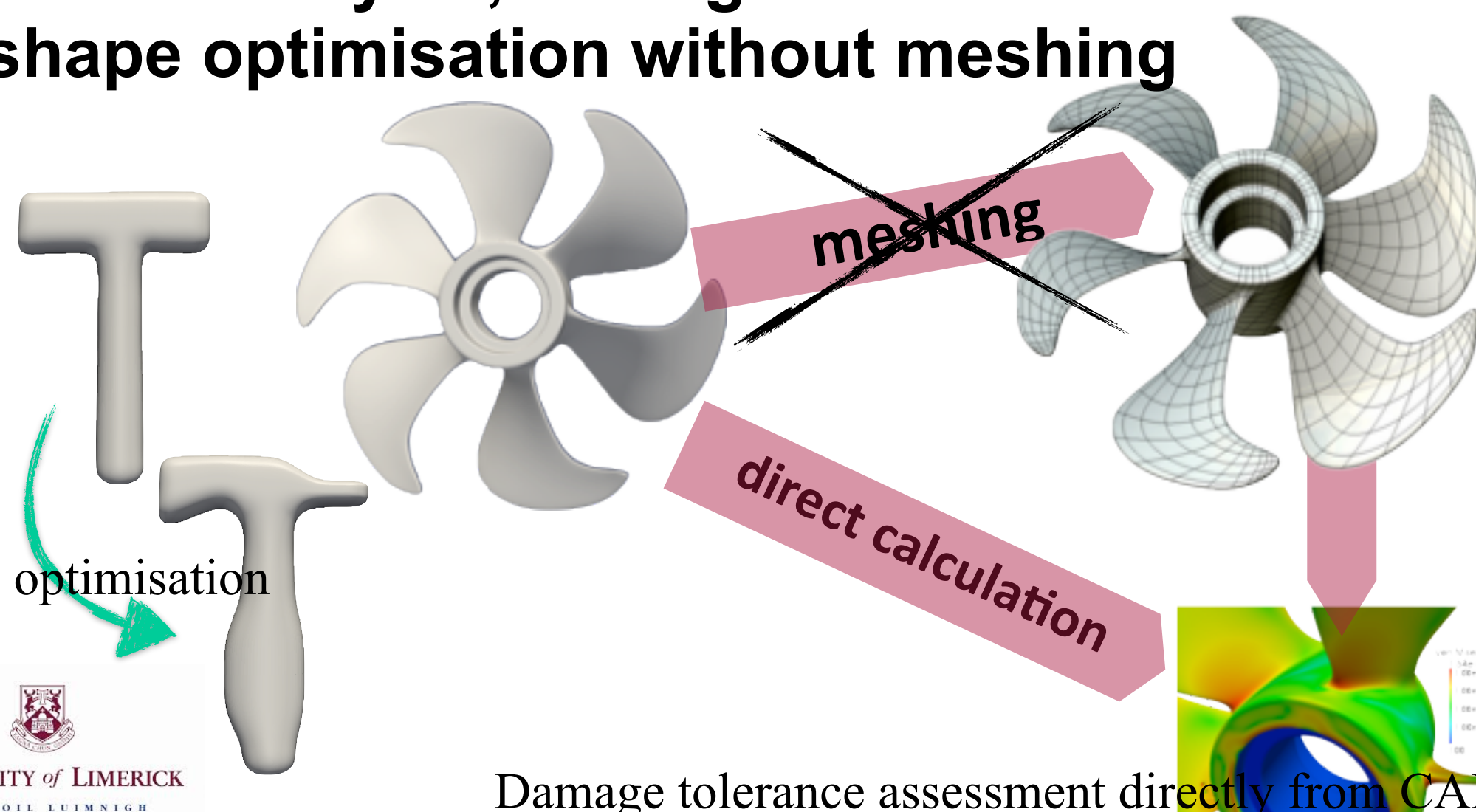


## CAD-Analysis & Image-based pipeline

### Implicit boundary



## Stress analysis, damage tolerance assessment and shape optimisation without meshing



### Isogeometric BEM

## Partners



Damage tolerance assessment directly from CAD